

## Glen Dye Moor Water Environment Assessment Summary

*A summary of the water environment at Glen Dye Moor and how specific assets have influenced design.*

For sensitivities such as the River Dee Special Area of Conservation (SAC) and Ground Water Dependant Terrestrial Ecosystems (GWDTE) third party advice was sought. Alongside these reports and tailored counsel, a series of best practice guides have been considered and used to inform woodland creation design.

These are:

- UK Forest Standard, Forestry Commission (2017)
- Practice guide for forest managers to assess and protect Groundwater Dependent Terrestrial Ecosystem (GWDTE) when preparing woodland creation proposals, Forest Commission Scotland (2018)
- Forestry & Water Scotland, Know the Rules 2<sup>nd</sup> Edition.
- Woodland for Water: Woodland measures for meeting Water Framework Directive objectives, Forest Research (2011)

Focused consultation with NatureScot and the Dee District Salmon Fishery Board (DDSB) took place to evaluate potential mitigations and impacts of the proposal drafts. The details shown on the following pages were discussed and reviewed by NatureScot and the DDSB and represent the most up to date version of forest design as of the date of this document. Further details of this consultation can be found in the consultation summary and consultee responses. It was also noted that the DDSB were “happy that this assessment and planting proposal is appropriate and would be beneficial to the river environment, biodiversity and climate resilience.” NatureScot have some concern regarding the planting in GWDTE buffers and we take this on board by ensuring that we will take care to assess each buffer and only plant where appropriate. No potential impacts on the SAC were noted.

### Watercourses

There is an estimated 122 kilometres of watercourses within the property boundary. The Water of Dye flows eastwards where it joins the Water of Feugh and eventually meets with the River Dee. Multiple small burns contribute to the Water of Dye, the most notable tributary being the Water of Charr which flows north to join the Water of Dye at the Charr Bothy in Glen Dye. To the north of the moor, the Water of Aven acts as the property boundary and takes on multiple small tributaries as it flows eastwards to join the Water of Feugh. The catchment of the Water of Feugh, including the Dye, Aven and all their tributaries is within the district of the Dee District Salmon Fishery Board.

The classified watercourses are all in good-high current condition based on the SEPA Water Classification scoring, which describes by how much their condition or status differs from near natural conditions. Using biological quality elements, hydrology, morphology, and assessment of invasive non-native species (INNS).



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Table 1: All watercourses which fall within the proposal, with their current condition and pressure based on data from the SEPA Water Classification Hub

Watercourse	Current Condition	Current Pressure
Water of Dye (lower catchment)	Good	No negative pressures
Water of Dye/Spital Burn	High	No negative pressures
Water of Dye/Water of Charr	Good	No negative pressures
Water of Feugh/Burn of Greendams	Good	No negative pressures
Water of Aven/ Feugh (upper catchment)	High	No negative pressures

### Special Area of Conservation (SAC) - River Dee

Part of the River Dee Special Area of Conservation is within the proposal area. The River Dee is designated for its population of Annex II species: Atlantic salmon (*Salmo salar*), Freshwater pearl mussel (*Margaritifera margaritifera*) and Otter (*Lutra lutra*).

Annex II Species	Condition
Atlantic Salmon ( <i>Salmo salar</i> )	favourable maintained (2011)
Freshwater Pearl Mussel ( <i>Margaritifera margaritifera</i> )	unfavourable no change (2003)
Otter ( <i>Lutra lutra</i> )	favourable declining (2012)

The creation of riparian woodlands around the headwaters of the River Dee should be beneficial to both freshwater pearl mussels and salmon through a reduction in diffuse pollution and a slowing of surface water run-off. The general site character has been classified as having 15% grassland and 14% broad-leaved woodland. We seek to increase this woodland percentage and believe that appropriate riparian planting can provide significant benefits to the SAC.

During operations appropriate measures will be in place to prevent pollution and to protect the water environment. All contractors will be expected to hold a copy of Know the Rules Booklet and compliance with the UK Forest Standard (UKFS), Forestry and Water Guidelines and the Water Environment (Controlled Activities) (Scotland) Regulations (CAR) will be checked.

### Riparian Woodlands

The riparian zone is the area of land either side of a river channel including the riverbank. These zones can be very ecologically rich and link habitats, offering migration corridors for invertebrates, birds, and mammals.

There is an estimated 122,375 meters of watercourses across the ownership of which currently only 5% are under woodland cover (6,641m). A key aspect of design at Glen Dye Moor is to buffer watercourses and plant along banksides and edges to facilitate the establishment of a healthy riparian woodland to achieve multiple benefits. We propose to increase the existing riparian cover from 5% to 54% through planting and naturally regenerating approximately 59,493 meters of watercourses with native trees as shown on the following maps (as seen in Table 2).

Table 2: Quantified meterage of watercourses and their proposed riparian woodland potential.

	Meters	%	Cover
Watercourses on Property	122371	-	-
Current riparian woodland	6,641	5%	current
Proposed riparian woodland	66,134	54%	proposed

We proposed this scale of afforestation because we believe that riparian woodland creation can provide a great number of benefits for the waters themselves as well as for the wider ecosystem.

Riparian woodland creation will:

- bind riverbanks together, reducing erosion and bank collapse
- slow flow of runoff and rivers to support flood risk management
- reduce river temperatures through dappled shade, which is important for Wild Salmon populations and other fish species
- provide terrestrial invertebrates and leaf litter for Wild Salmon
- improve the water body status through the trapping of sediments and filtering out pollutants
- improve overall biodiversity, habitats and creates nature networks

We proposed the planting and natural regeneration of an additional approx.. 59,493 meters of riparian woodland creation across the property of which a high percentage falls within the high scoring areas identified by Scottish Forestry through the FGS Target Woodlands for Riparian Benefits.

As a minimum standard each watercourse will be buffered from commercial conifer planting according to the UKFS minimum buffer width, ranging from 10-20m and then where suitable further buffered by an extra 10m. The riparian planting width therefore varies across the site to suit the channel size, but the overall planting area is likely to be around 241 hectares which will account for

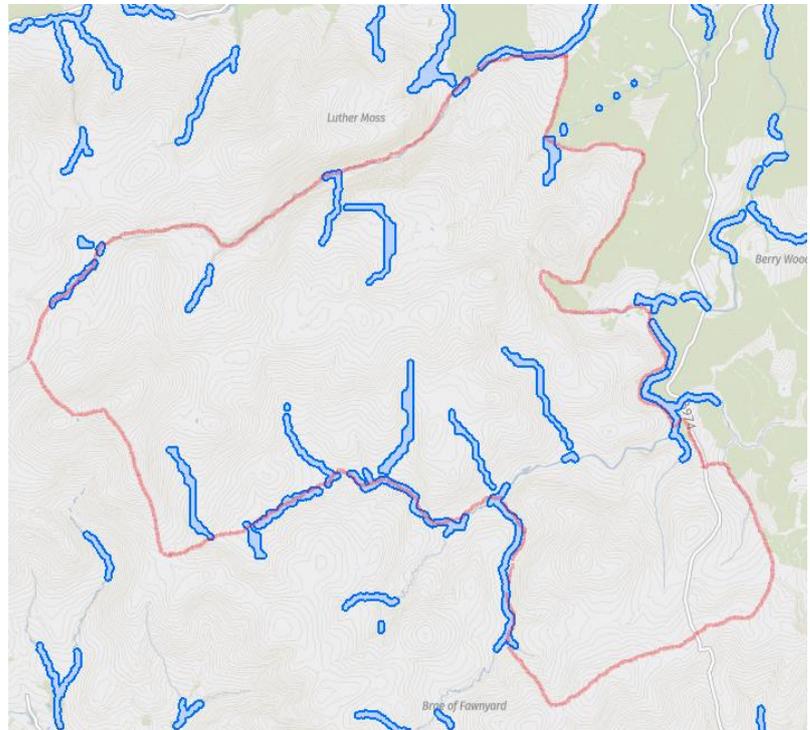


Figure 1: Scottish Forestry Map Viewer - FGS Target Woodlands for Riparian Benefits layer with Glen Dye Moor property boundary.

54% watercourse cover, a major increase from the existing 5% cover, accounting for over 66,000 metres of watercourse channel which will become wooded.

Planting density will meet FGS requirements of between 1100 and 1600 trees per ha (spaced 2.5x2.5m) unless Native Low-density Broadleaves has been selected in which case planting density will be 500 trees per ha (spaced 4.4x4.4m). Species mixes will be appropriate to the setting but will likely consist of willow, alder, birch (NVC types W3, W4, W7, W20) and would mimic the existing riparian woodland types currently found around the local area. Natural regeneration around watercourses is encouraged and all areas within 200m of existing seed sources which are not proposed for planting are intended to naturally regenerate.

There are a few priority river segments, shown on the maps attached. These are seen as of utmost importance for riparian woodland creation. The first is the headwaters of the Burn of Greendams, which has been identified as important for Wild Salmon and Sea Trout. We aim to support the Scottish Government's Scottish Wild Salmon Strategy through this project. Riparian woodland creation at Greendams will have an influence on the health of Scotland's wild salmon population. Currently neighbouring forest cover in the form of conifer plantation comes to 200m above sea level (a.s.l) and riparian cover within our property boundary is sporadic within the first 5-10m of the riverbank up to 360m a.s.l. We are proposing a native broadleaf riparian planting up to 390m a.s.l and further natural regeneration is expected up to an elevation of 460m. We seek to consolidate the future of wild salmon in these headwaters to protect the ecosystem services they provide.

The second is the Brocky Burn, which flows off the hillside down towards Charr Bothy and joins the Water of Dye. It was classified with the highest priority band in Marine Scotland's National Marine Plan Interactive (NMPI) mapping system for "Tree planting prioritisation for shading rivers – where both banks can be planted". This mapping system was created to help land managers correctly prioritise rivers. The greatest threat to the Brocky Burn is temperature increase and shading is paramount for mitigation. In the face of a changing climate, it is important to reduce river temperatures for the health of freshwater fish and river biodiversity levels. Currently there is no forest cover up the Brocky Burn, our design proposes an initial 20-40m buffer either side of the burn which is expected to naturally regenerate with native broadleaf riparian planting continuing up the gully sides to an elevation of 390m. Further natural regeneration is expected to creep up to 415m a.s.l, this will provide vital shade to this burn which currently has no woodland cover.

The final priority segment is the Water of Dye headwaters including the Burn of Saughs. On Marine Scotland's NMPI mapping system for "Management priority on a scale of 1:9 where highest priority has high river temperature and high climate sensitivity" it was classified as a 4:9. The headwaters have no woodland cover currently which increases its fluvial risk during a flood event, which is more likely in a changing climate and allows for the river temperature to spike in the summer months. We propose riparian planting of native broadleaves along the headwaters and burn where suitable up to 430m a.s.l and expect natural regeneration to take place filling in the remainder of the burn sides up to 460m a.s.l. It is expected that trees planted on the Water of Dye headwaters will have a positive effect on future flooding events through reducing the amount of and slowing the rate of water directly entering the river system.

## Groundwater Dependent Terrestrial Ecosystems (GWDTE)

Botanaeco Ltd were instructed to carry out a habitat-focused survey and assessment of Glen Dye Moor in 2022. The aim of the report was to assess the habitat, species importance and sensitivity of GWDTE.

Their report showed that the underlying geology was Late Silurian to Early Devonian, igneous intrusion which is known to have “‘small amounts of groundwater in [the] near surface weathered zone and secondary fractures’ and ‘rare springs’”. The areas of GWDTE were assessed in relation to their potential groundwater dependency as shown in the following table.

Table 11: Assessment of groundwater dependency.

Phase 1 habitat code & title	National Vegetation Classification code & title	Notes	Groundwater dependency	
			Guidance	Site-specific
B2.2 Neutral grassland - semi-improved	M610a <i>Holcus lanatus</i> - <i>Juncus effusus</i> rush-pasture, typical sub-community	<ul style="list-style-type: none"> <li>Associated with damp areas of acid grassland invaded by rushes.</li> <li>Not especially wet soils and no features associated with groundwater emergence are apparent.</li> </ul>	Moderate	Low
	M15a <i>Trichophorum cespitosum</i> - <i>Erica tetralix</i> wet heath, <i>Carex panicea</i> sub-community	<ul style="list-style-type: none"> <li>High groundwater dependency is apparent in the perched position of these wetland areas on steep slopes that would be well-drained without recharge from diffuse groundwater emergence.</li> <li>The presence of indicators of mild base-enrichment (e.g. carnation sedge &amp; common yellow-sedge) reveals the influence of geology/groundwater on the vegetation composition.</li> <li>Variable levels of groundwater dependency.</li> </ul>	Moderate	High
D2 Wet dwarf shrub heath	M15b <i>Trichophorum cespitosum</i> - <i>Erica tetralix</i> wet heath, typical sub-community	<ul style="list-style-type: none"> <li>Groundwater dependency is apparent in the perched position of some areas on steep slopes that would be well-drained without recharge from diffuse groundwater emergence. These areas are associated with ombrogenous species (rather than indicators of base-enrichment) so the influence of groundwater is assessed to be Moderate.</li> <li>More extensively, the M15b wet heath is located across the summit of ridges or upper-slopes above the likely level of groundwater emergence. In these areas, rainwater alone is sufficient to explain the presence of the wet heath, without inputs of groundwater.</li> <li>Variable levels of groundwater dependency.</li> </ul>	Moderate	Low / Moderate
	E2.3 Flush and spring - acid/neutral flush	M6 <i>Carex echinata</i> - <i>Sphagnum fallax/denticulatum</i> mire - all sub-communities.	<ul style="list-style-type: none"> <li>Low groundwater-dependency when located in shallow, waterlogged depressions, especially within eroded channels or shallow valleys fed by surface water draining from the surrounding blanket bog. Many such areas are located across the uppermost parts of the site, above the likely level of groundwater emergence.</li> <li>High groundwater-dependency when located at breaks-in-slope where diffuse groundwater emergence is apparent, especially in the absence of obvious, surface water sources.</li> </ul>	High
E2.3 Bryophyte-dominated spring	M32a <i>Philonotis fontana</i> - <i>Saxifraga stellaris</i> spring, <i>Sphagnum denticulatum</i> sub-community	<ul style="list-style-type: none"> <li>Obviously associated with groundwater discharging at springs.</li> </ul>	High	High

The areas of GWDTE which were classified as having moderate and high groundwater dependency at a site-specific level were removed from proposed planting areas. A 20m buffer from the edge of the habitat has been applied to these areas and will be planted (approximately 38 hectares) with low density native species where appropriate to enhance the wetland habitat. Focus will be on shrubby species of trees with a focus on willow (~75%) with other species mixed in occasionally such as dwarf birch, downy birch and possibly alder if in a more sheltered area to accomplish a ‘wet woodland’ effect. The planting of individual trees would be denser closest to surrounding new planting and feather out significantly as it approaches the wetland itself. Taller and large rooted species such as birch and alder would be planted furthest from the wetland boundary.

The aim is to accomplish multiple environmental benefits. Firstly, the provision of a transitional area between more dense new planting and the wetland itself. It is hoped that this transition area will provide a valuable ecotone or edge habitat which would otherwise be missing from a stark line between 1600 trees per hectare and open ground. Secondly, improved ecological value from a currently heavily degraded ecosystem without most of the later seral habitats associated with an upland site to a thriving wetland ecosystem which would create interest for rare insects, birds, and cover/foraging for mammals (and bats). We feel this is a feature of importance which is commonly missing from new woodland creation design.

The wetland habitats are listed in the table below and in general fall into two NVC groups: M6 and M15. M6 is a poor-fen with small sedges or rushes on a Sphagnum underlayer. It is the major soligenous community of peats and peaty gleys irrigated by base poor waters and often stands in small pockets surrounded by other mire communities, grassland, or heath. Where drainage and grazing are combined, this habitat would likely revert to wet scrub and woodland. M15 a wet heath characterised by moist, acid and peats and peaty mineral soils. Progression to woodland on this habitat is possible overtime.

<b>NVC Wetland Habitat Types Present</b>	
M15a-M15b mosaic	M6c-M6d-U4a mosaic
M15a-M15b-U5a mosaic	M6c-U5a mosaic
M15b <i>Trichophorum germanicum</i> - <i>Erica tetralix</i> wet heath, typical sub-community	M6c <i>Carex echinata</i> - <i>Sphagnum fallax/denticulatum</i> mire, <i>Juncus effusus</i> sub-community
M15a-M6d mosaic	

### **Drinking Water Assets**

Glen Dye Moor site boundary falls within a Drinking Water Catchment where a Scottish Water (SW) abstraction unit is located. Operations will be required to will follow both UKFS guidance and “Guidance on Forestry Activities Near SW Assets” document provided by SW regarding activities within their Drinking Water Protected Areas.

There are no known private water supplies on site. If any should be identified during operations, then great care will be taken to protect water quality. Buffer distances noted within the Know the Rules booklet will be followed and further advice sought.

A reservoir exists to the south of the property, in Glen Dye and near Charr Bothy. There is however some ambiguity surrounding who is responsible for this asset and discussions with SW are ongoing.

For greater detail and justification for planting designed, please refer to the Species Design Mapping Suite which puts the coupes related to the water environment into context.

# Riparian Enhancement at Glen Dye Moor

UKFS includes the following guidance for protecting watercourses:

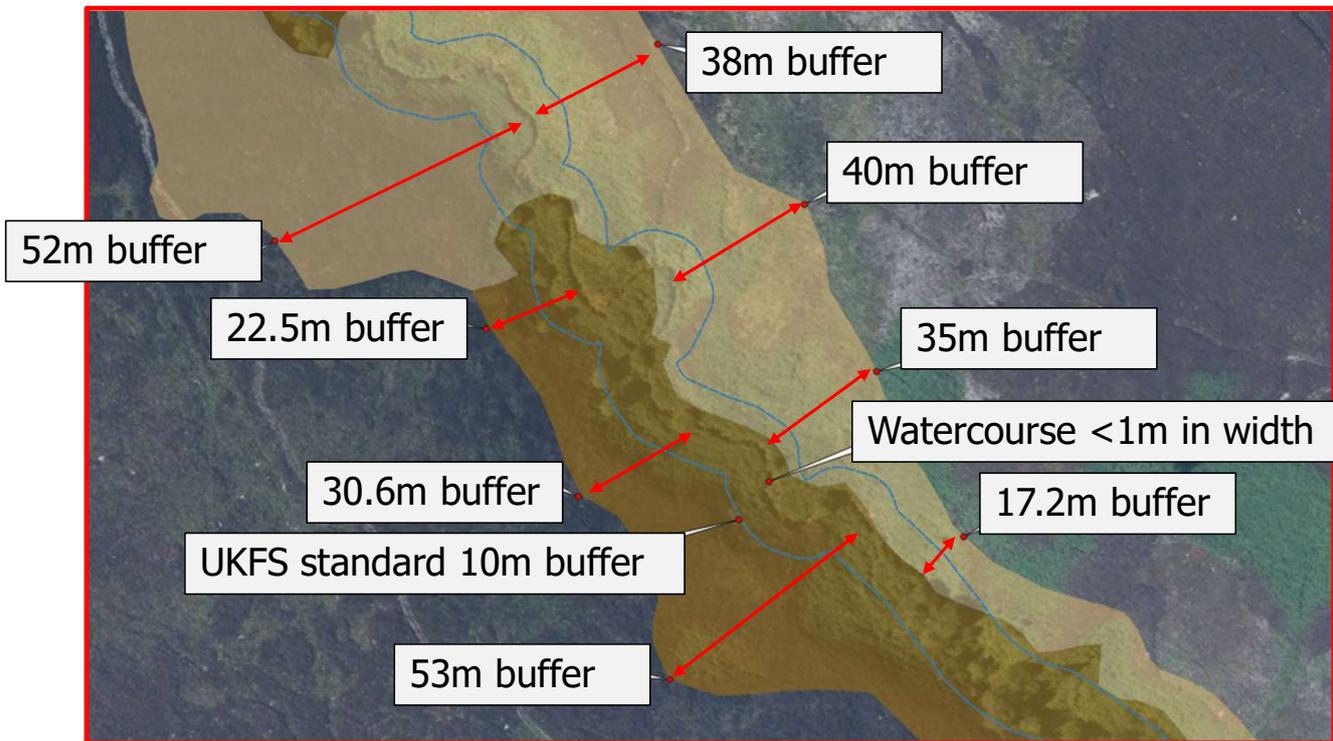
The recommended minimum widths of buffer areas from the bank top of the waterbody or the edge of standing water are set out below. These minimum widths apply to all forestry activities, except for:

Table 9.2 Minimum buffer widths for forestry activities (other than the exceptions listed above) from forest edge to watercourse, waterbody or abstraction point.

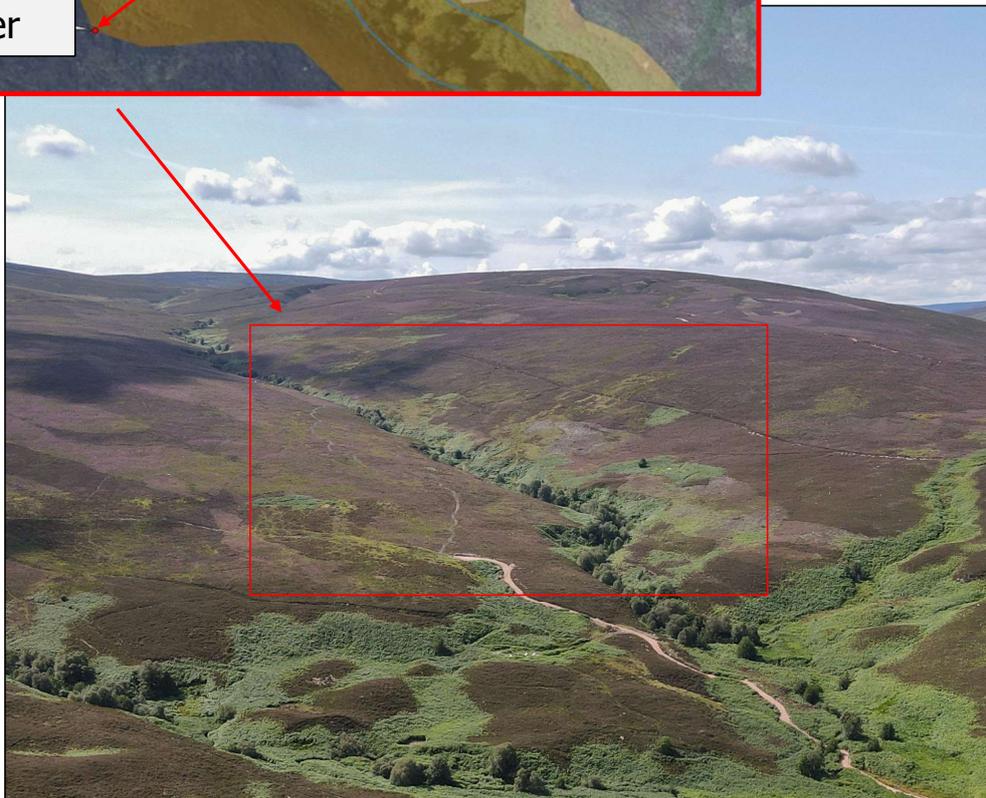
- hinge mounding
- inverted mounding
- direct planting of native trees and shrubs and other ecologically appropriate broadleaved trees to create riparian woodland

Buffer width	Situation
10 m	Along permanent watercourses with a channel less than 2 m wide.
20 m	Along watercourses with a channel more than 2 m wide and along the edge of lakes, reservoirs, large ponds and wetlands.
50 m	Around abstraction points for public or private water supply, such as springs, wells, boreholes and surface water intakes.

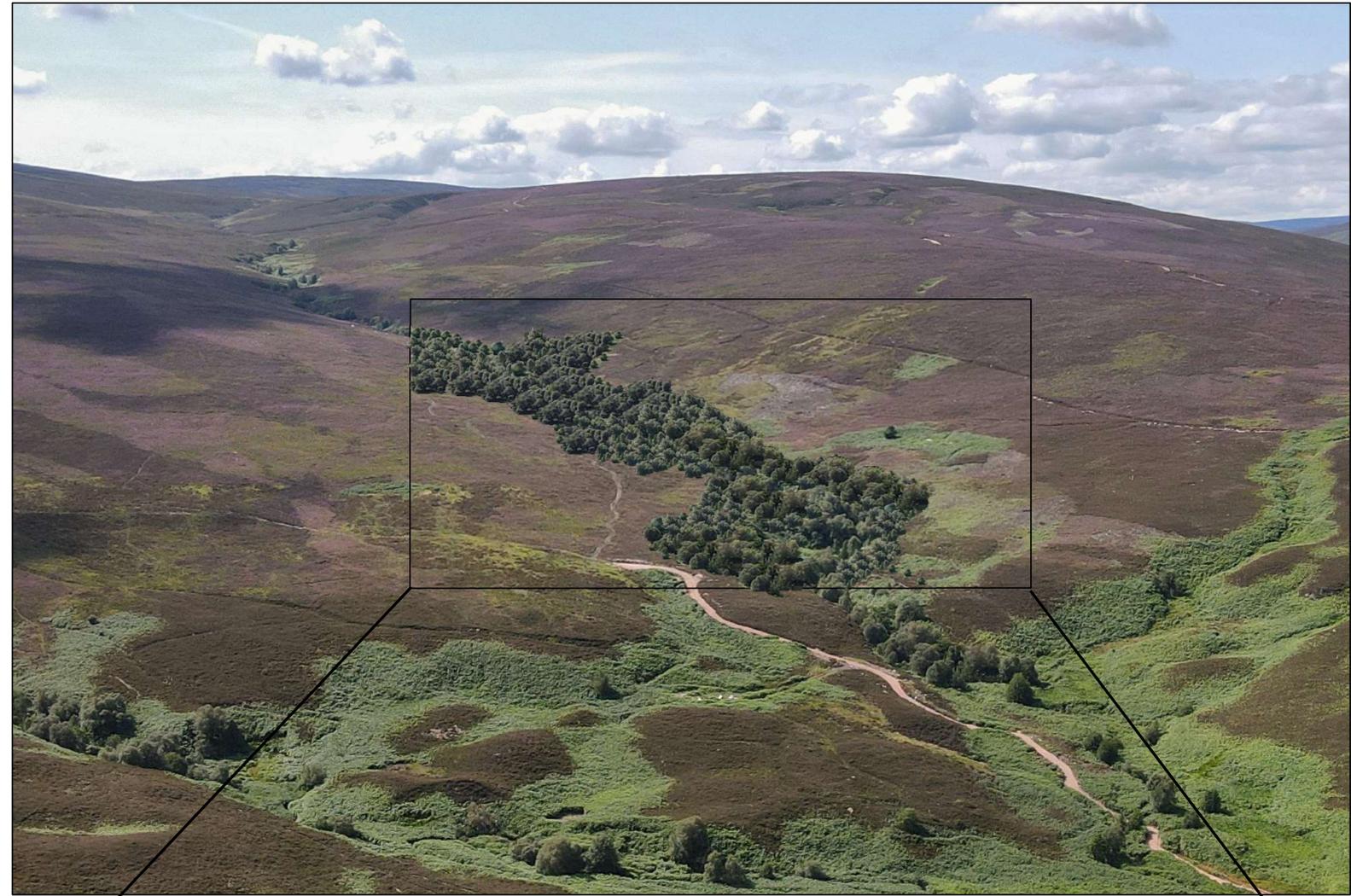
*Along tributaries to Greendams, additional measures have been adopted to further enhance the riparian setting around these important watercourses. The image above shows extended buffer distances for the area shown on the photograph right.*



- Standard minimum protection buffers from watercourses will be expanded where this improves protection of site sensitivities. Standard buffers are 10m-20m, expanded up to an additional 50m where suitable to conditions.
  - Along tributaries to the Burn of Greendams, a minimum buffer greater than the standard will be provided.
- Riparian woodlands (along riverbanks and around watercourses) will be created with the following species composition where planting is proposed. Willow (40%), alder (25%), birch (25%), other under-represented species such as aspen, hazel, holly, etc. (10%).



# Riparian Enhancement at Glen Dye Moor



Standard UKFS minimum  
buffer distance

Enhanced riparian buffer distance following  
the terrain and site conditions



## Riparian Enhancement at Glen Dye Moor

- Planting of a transitional 'wet woodland' mix within 20m of ground water dependant terrestrial ecosystems, GWDTes, (creating an ecotone between dense planting and GWDTes). This will be planted at a variable density incorporating gaps within the canopy while meeting the average stocking density required by funding contracts.
- No commercial conifer planting will occur within the 20m buffer. GWDTes will not be planted.
- A semi-open canopy mixture will be created using riparian scrub species such as willow similar to image 3 below.
- Density of planting around GWDTes will be variable and result in semi-open canopy. Dense clumps will be offset by gaps of no planting as illustrated below.

Image 1 below. An example of transitional woodland

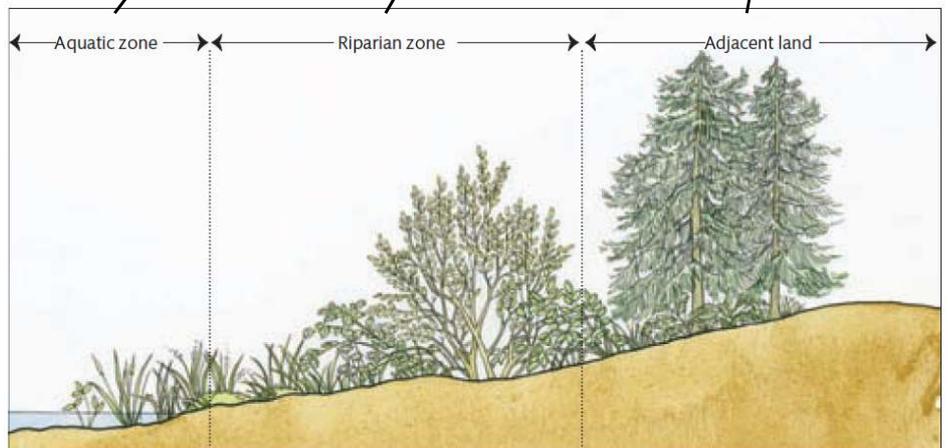
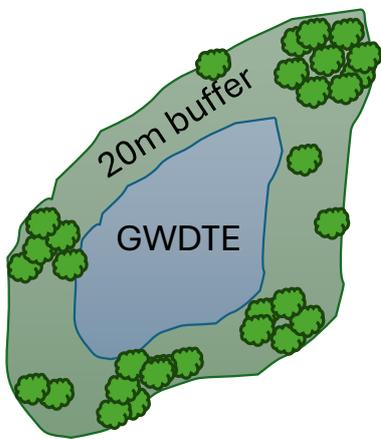


Image 2 above. Zones of transition. The riparian zone around GWDTes is 20m wide and does not include any conifer planting. The riparian area contains mostly scrub species such as willow

Image 3 below. An area of scrub woodland including willow, birch and juniper



# Riparian Enhancement at Glen Dye Moor

- Planting of native species and natural regeneration (where seed sources exist) around riparian areas where suited to site to increase shading, reduce summer temperatures, provide nutrient input through leaf fall and recruit deadwood.
- All constraints maps will display the River Dee SAC boundary where present
- Around the River Dee SAC, bankside native woodland creation will take place and natural regeneration will be encouraged through a programme to reduce deer densities.
- Riparian woodlands (along riverbanks and around watercourses) will be created with the following species composition where planting is proposed. Willow (40%), alder (25%), birch (25%), other underrepresented species such as aspen, hazel, holly, etc. (10%).

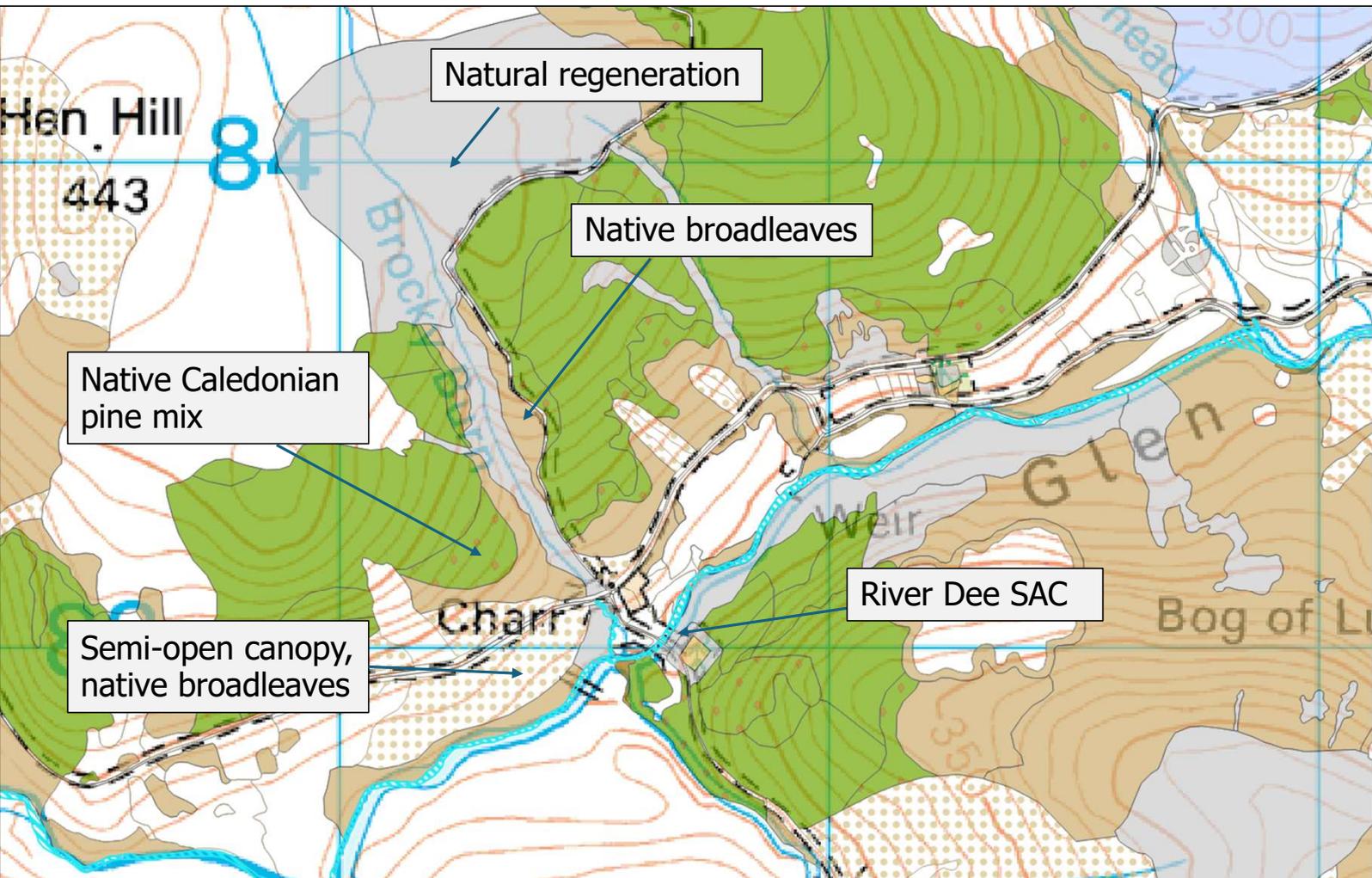
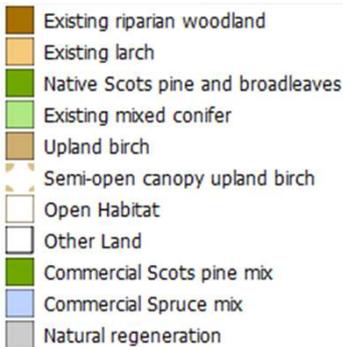


## RIVER DEE SPECIAL AREA OF CONSERVATION (SAC)

Promotion of measures to increase resilience to climate change, particularly the creation of native riparian woodland and improved connection with floodplains. Measures to promote coordinated, catchment-scale activity are particularly important. Native tree planting in appropriate locations would help improve the riparian habitat for all three species.

It is proposed that riparian woodland and riverside scattered trees should be encouraged in appropriate locations along rivers, streams and loch-sides.

Preference would be given to natural regeneration where a seed source exists, but tree planting of native species would also be considered. Moorland water courses are important for the spring salmon component of the population, which has been declining, so measures to address this would be helpful. Riparian woodland and scattered trees benefit Atlantic salmon from shading and nutrient inputs. High water temperatures are harmful to Atlantic salmon and shading helps to address this, and leaves and invertebrates falling into the water would increase the invertebrate biomass, which will provide better feeding. The wet and dry heath habitats are very extensive on the relevant sites, and the area of woodland/scattered trees proposed would be very small, with a cumulative area of less than 1%.



**Legend**

- Project Boundary
- Special Area of Conservation
- Groundwater Dependent Terrestrial Ecosystem
- Planting in GWDTE
- Watercourse Buffers
- Riparian Planting
- Watercourse
- Priority River Segments

Riparian woodland creation will:

- bind riverbanks together, reducing erosion and bank collapse
- slow flow of runoff and rivers to support flood risk management
- reduce river temperatures through dappled shade, which is important for Wild Salmon populations and other fish species
- provide terrestrial invertebrates and leaf litter for Wild Salmon
- improve the water body status through the trapping of sediments and filtering out pollutants
- improve overall biodiversity, habitats and creates nature networks

The headwaters of the Burn of Greendams has been identified as important for Wild Salmon and Sea Trout. We are proposing a native broadleaf riparian planting up to 390m a.s.l and further natural regeneration is expected up to 460m a.s.l.

River Dee SAC is designated for Atlantic Salmon, Freshwater Pearl Mussel and Otter.

The Water of Dye headwaters including the Burn of Saughs was classified by Marine Scotland as a 4:9 for management priority on a scale of 1:9 for high river temperature and high climate sensitivity. We are proposing a mixture of native broadleaf riparian planting up to 430m a.s.l and further natural regeneration is expected up to 460m a.s.l.

The Brocky Burn was classified with the highest priority band in Marine Scotland's National Marine Plan Interactive (NMPI) mapping system for "Tree planting prioritisation for shading rivers – where both banks can be planted". The greatest threat is temperature increase and shading is paramount for mitigation. Our design proposes a combination of native riparian planting and natural regeneration up to and elevation of 415m.

Estimated 122,375 meters of watercourses across the ownership of which currently only 5% are under woodland cover (6,641m). We propose planting and naturally regenerating approx. 66,134 meters of watercourse, this is a 49% increase.

Groundwater Dependent Terrestrial Ecosystems (GWDTE) classified as having low groundwater dependency will be buffered by 20m and we proposed planting this will a low density native species where appropriate to enhance the wetland habitat.

